Endangered and Threatened Crayfishes (Decapoda: Cambaridae) of Ohio[1]

RAYMOND F. JEZERINAC, Department of Zoology, The Ohio State University at Newark, University Drive, Newark, OH 43055.

ABSTRACT. Field studies during the past five years indicate that the crayfish *Orconectes obscurus* (Hagen) is not an endangered species. However, the introduction of *O. rusticus* (Hagen) into Sunfish Creek has almost eliminated *O. obscurus* from this watershed. *Orconectes sloanii* Bundy is considered threatened because it has not been collected recently from many localities where it was found formerly. Additional information is needed to determine the status of four other taxa. *Orconectes virilis* (Hagen) occurs only in the East Branch of the Chagrin River. This stream should be investigated to determine if *O. rusticus* is eliminating *O. virilis*. *Orconectes propinquus* (Girard) apparently has been extirpated from the Maumee, Portage, Sandusky, and Rocky rivers. The status of this species in the Grand and Ashtabula rivers and Conneaut Creek is unknown. *Orconectes sanbornii erismophorous* Hobbs & Fitzpatrick has been collected from only one locality in the lower Scioto River basin. The taxonomic status and distribution of what has been called *O. juvenilis* (Hagen) in Ohio needs special attention. This species is either *O. spinosus* (Bundy) or a closely related undescribed species that has been collected, usually in small numbers, from the Little Miami River, lower Scioto River, and Eagle and Pine creeks in southern Ohio.

OHIO J. SCI. 86 (4): 177-180, 1986

INTRODUCTION

During the last 20 years, there has been considerable national and international interest in identifying those plants and animals that may be threatened or endangered species or populations. In Ohio, this has resulted in the publication of lists for vertebrates (Smith et al. 1973, Ohio Dept. Nat. Res. 1978), some invertebrates (Ohio Dept. Nat. Res. 1978), and plants (Cooperrider 1982). This paper provides information on the status of crayfish taxa (species, subspecies, and undetermined forms) in Ohio.

Of the 19 different species and forms of crayfishes occurring in Ohio (Table 1), only *Orconectes obscurus* is designated as endangered by Ohio law. Data presented in this paper indicates, however, that it is neither threatened nor endangered in most streams where it has been recorded. One species, *O. sloanii,* is herein recommended for threatened species status and one subspecies (*O. sanbornii erismophorous*) and three species (*O. propinquus, O. virilis,* and *O.* sp) for special interest status. The distributional ranges of these six crayfishes in North America and Ohio, including a map, are described. Pertinent literature is cited, and the status of these forms in Ohio as endangered, threatened, or of special interest is discussed.

METHODS AND MATERIALS

The nomenclature of Hobbs (1974) is followed. The distribution map is based upon catalogued material in The Ohio State University Museum of Zoology (OSUMZ), Columbus, Ohio, published literature, and collections in The Ohio State University at Newark Crayfish Museum (OSUNCM), Newark, Ohio. The number in parenthesis following a county name indicates the number of collections within that county. The OSUNCM data are in a computer data base (IBM PC-FILE III) and will be provided to interested individuals upon request. The status of each taxon follows the definitions established by the Ohio Division of Wildlife, Division of Natural Areas and Preserves (Unpublished 1982). The literature cited in this report includes all published papers on Ohio populations of the crayfishes in the following list, as well as selected references concerning their taxonomy, identification, distribution, ecology, and life histories.

[1]Manuscript received 3 February 1986 and in revised form 19 May 1986 (#86-7).

RESULTS AND DISCUSSION

ORCONECTES OBSCURUS **(Hagen 1870).**

Range: This species has a restricted range. It occurs in the upper Ohio River system in Ohio (Turner 1926, Rhoades 1944a), Pennsylvania (Ortmann 1906), West Virginia (Schwartz and Meredith 1960), and New York (Crocker 1957). It also occurs in the Genesee, Susqehanna, and Mohawk rivers in New York (Crocker 1957). This species has been introduced into Ontario, Canada, (Crocker and Barr 1968), Maine, and Massachusetts (Crocker 1979).

Ohio Distribution: This species is confined to streams and tributaries of the Ohio River north of the southern boundary of the Flushing Escarpment (Fig. 1). Collections are from Belmont (19), Columbiana (24), Jefferson (5), Mahoning (5), Monroe (5), Portage, Stark (1), and Trumbull counties.

Status: *O. obscurus* is the only Ohio crayfish designated as endangered by Ohio law (Ohio Dept. Nat. Res. 1978). This status should be changed, however, to non-endangered and non-threatened. During the last five years, this species has been found at 59 different sites in six east-central Ohio counties. The species occurs in 13 different tributaries of the Ohio River drainage (Table 2). In 12 of these streams, *O. obscurus* is common to abundant. However, this species is threatened in the Sunfish Creek drainage owing to the introduction of another crayfish species. In this stream, *O. obscurus* is found only in headwater tributaries, whereas *Orconectes rusticus* (Girard 1852) is abundant in the main stream. This dominance of *O. rusticus* within the main stream also occurs in Ohio Brush Creek (Flynn and Hobbs 1982), Rocky Fork Creek (Rhoades 1962a), and the Chagrin River (Jezerinac 1974). *Orconectes rusticus* is apparently replacing the native species (Jezerinac 1982, Flynn and Hobbs 1982).

Literature: Ortmann 1906, Turner 1926, Rhoades 1944a, Crocker 1957, Fitzpatrick 1967, Crocker and Barr 1968, Fielder 1972, and Hobbs 1974.

ORCONECTES SLOANII **(Bundy 1876).**

Range: The range of *O. sloanii* is very restricted. It has been collected only in the Ordovician limestone and shale

TABLE 1

A Taxonomic List of the Crayfishes (Decapoda: Cambaridae) of Ohio.

PHYLUM ARTHROPODA
CLASS CRUSTACEA
ORDER DECAPODA
FAMILY CAMBARIDAE
SUBFAMILY CAMBARINAE
Genus *Procambarus* Ortmann 1905
Subgenus *Ortmannicus* Fowler 1912
Procambarus (Ortmannicus) acutus acutus (Girard 1852)
Subgenus *Scapulicambarus* Hobbs 1972
Procambarus (Scapulicambarus) clarkii (Girard 1852)
Genus *Orconectes* Cope 1872
Section Limosus Ortmann 1905
Group Limosus Rhoades 1944b
Orconectes sloanii (Bundy 1876)
Section Propinquus Ortmann 1905
Group Propinquus Ortmanni 1905
Subgroup Propinquus Fitzpatrick 1967
Orconectes propinquus (Girard 1852)
Subgroup Sanborni Fitzpatrick 1967
Orconectes obscurus (Hagen 1870)
Orconectes sanbornii sanbornii (Faxon 1884)
Orconectes sanbornii erismophorous Hobbs & Fitzpatrick 1962
Section Rusticus Ortmann 1905
Group Rusticus Ortmann 1905
Orconectes rusticus (Girard 1852)
Orconectes sp.
Section Virilis Ortmann 1905
Group Virilis Ortmann 1905
Orconectes immunis (Hagen 1870)
Orconectes virilis (Hagen 1870)
Genus *Cambarus* Erichson 1846
Subgenus *Cambarus* Erichson 1846
Cambarus (Cambarus) bartonii carinirostris Hay 1914
Cambarus (Cambarus) bartonii cavatus Hay 1902
Cambarus (Cambarus) ortmanni Williamson 1907
Cambarus (Cambarus) sciotensis Rhoades 1944a
Subgenus *Lacunicambarus* Hobbs 1969
Cambarus (Lacunicambarus) sp. A (eastern Ohio)
Cambarus (Lacunicambarus) sp. B (western Ohio)
Subgenus *Puncticambarus* Hobbs 1969
Cambarus (Puncticambarus) robustus Girard 1852
Genus *Fallicambarus* Hobbs 1969
Subgenus *Creaserinus* Hobbs 1973
Fallicambarus (Creaserinus) fodiens (Cottle 1863)

regions of southeastern Indiana and southwestern Ohio (Rhoades 1941, Hobbs 1974).

Ohio Distribution: In Ohio, *O. sloanii* occurs primarily in tributaries of the Great Miami River system south of the confluence of Greenville Creek (Rhoades 1941, 1944a, St. John 1982) (Fig. 1). Specimens have been obtained from Butler, Darke, Hamilton, Montgomery, Preble (1), and Warren counties.

Status: Threatened (T). Most of the distribution data for this species were provided by Rhoades (1941). The map for *O. sloanii* that is presented is probably incorrect since numerous visits to a number of formally occupied sites have failed to produce this species. Rhoades (1941) stated that individuals of this species are "most often found near algal beds and aquatic vegetation" in streams that have stabilized banks and flat, water-worn, stone bottoms. I collected this species from a small stream having a substrate of limestone cobbles and bedrock. The species was not abundant, but greater numbers were found in the absence of *O. rusticus* suggesting that *O. rusticus* competes with, or is displacing, *O. sloanii*. *Orconectes sloanii* is threatened by urban development,

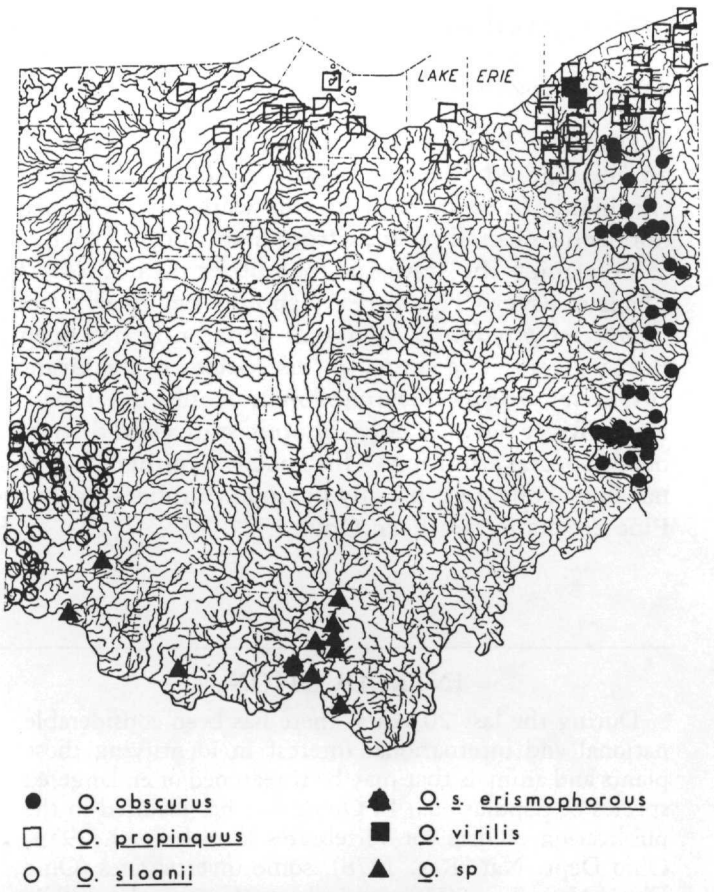

FIGURE 1. Ohio distribution of *Orconectes obscurus, O. propinquus, O. sloanii, O. s. erismophorous, O. virilis,* and *O.* sp. Insert: the boundary of the Flushing Escarpment and Mahoning River basin.

stream impoundment, water pollution, siltation, and by competition with *O. rusticus*. Because of its limited Ohio distribution, any additional population losses may lead to its extirpation in the state.

Literature: Bundy 1876, Rhoades 1941, 1944a and 1962b, Hobbs 1974, and St. John 1982.

***ORCONECTES PROPINQUUS* (Girard 1852).**

Range: *O. propinquus* has a rather extensive range that includes a portion of the upper Mississippi River and Great Lakes drainages. Records are from the upper Wabash River and upper Illinois River basins in Illinois; upper Mississippi River watershed in Illinois, Iowa, and Wisconsin; the Great Lakes drainage in Ontario and Quebec, Canada; Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, New York, and Vermont; and the upper Mohawk River drainage in New York (Crocker 1957, 1979, Crocker and Barr 1968, Hobbs 1974).

Ohio Distribution: Turner (1926), OSUMZ, and OSUNCM records document the presence of this species along the southern shore of Lake Erie, from waters surrounding South Bass island, and in Lake Erie tributaries except the Huron, Vermilion, Rocky, and Cuyahoga rivers (Fig. 1). Records are from Ashtabula (5), Cuyahoga (6), Erie, Geauga (49), Lake (17), Lorain, Lucas, Ottawa (1), Portage (7), Sandusky, Trumball (1), and Wood counties.

Status: Special Interest (S). Although this species has a broad distribution, recent collections in Ohio suggest that it has been extirpated from the Maumee, Portage, Sandusky, and Rocky rivers. The Chagrin River popu-

TABLE 2
Recent Ohio Collections of Orconectes obscurus *(Hagen)*

Drainage (No. of collections)	County (No. of collections)	First-form males	Second-form males	Females	Total
Big Run (1)	Monroe (1)	2			2
Captina Creek (16)	Belmont (16)	54	59	162	275
Cross Creek (1)	Jefferson (1)		4	2	6
Island Creek (1)	Jefferson (1)			5	5
Little Beaver Creek (27)	Columbiana (23)	124	53	192	369
	Mahoning (4)	4	6	40	50
Mahoning River (3)	Mahoning (2)	1	13	5	19
	Stark (1)	3	2	10	15
McMahon Creek (1)	Belmont (1)	1		1	2
Opossum Creek (1)	Monroe (1)		1	3	4
Pipe Creek (1)	Belmont (1)	2	7	10	19
Rush Creek (1)	Jefferson (1)		1	4	5
Sunfish Creek (3)	Monroe (3)	16	3	24	43
Wheeling Creek (1)	Belmont (1)		1	3	4
Yellow Creek (2)	Jefferson (2)		2	1	3

lation is threatened because of the introduction of *O. rusticus* into the basin (Jezerinac 1982). The status of the species in the Grand and Ashtabula rivers and in Conneaut Creek is unknown. *Orconectes propinquus* is threatened by stream impoundment, pollution, siltation, and the introduction of *O. rusticus*.

Literature: Ortmann 1906, Turner 1926, Creaser 1933a, 1933b, Van Deventer 1937, Crocker 1957, Fitzpatrick 1967, Crocker and Barr 1968, Fielder 1972, Hobbs 1974, and Jezerinac 1982.

***ORCONECTES VIRILIS* (Hagen 1870).**

Range: This species has an extensive native range including lakes and streams "from Saskatchewan to Ontario, Canada, and from Montana and Wyoming to New York and southwestern Maine" (Hobbs 1974). It has also been introduced into California, Maryland, parts of New England, and Tennessee (Hobbs 1974).

Ohio Distribution: This species occurs only in the East Branch of the Chagrin River in northeastern Ohio (Jezerinac 1974) (Fig. 1). Records are from Geauga (10) and Lake (3) counties.

Status: Special Interest (S). Jezerinac (1982) suggested that the Chagrin River population may be the last remnant of a much broader distribution of this species in northern Ohio, a range that has been shrinking because of the changing climatic conditions in the region since the Wisconsin glacial period. Another possibility is that *O. virilis* may have been introduced successfully into the Chagrin River drainage. Lodge et al. (1985) have implicated *O. rusticus* in the local extirpation of *O. virilis* in northern Wisconsin. Fortunately, a base-line study has been completed on the Chagrin River population (Jezerinac 1982); further study of this basin will clarify the status of *O. virilis*.

Literature: Turner 1926, Rhoades 1944a, Crocker and Barr 1968, Hobbs 1974, and Jezerinac 1974, 1982.

***ORCONECTES* sp.**

Range: Uncertain. See remarks under status.

Ohio Distribution: This taxon has been recorded from the Little Scioto River, eastern tributaries of the lower Scioto River, Eagle and Pine creeks, and the Little Miami River in Brown (1), Hamilton, Jackson, Lawrence (1), Pike, Scioto (2), and Warren counties (Fig. 1).

Status: Special Interest (S). The taxonomic status and distribution of this crayfish is very unclear. Turner (1926) and Rhoades (1944a) cited distribution records for *O. juvenilis* in Ohio. After examining material from the type locality of *O. juvenilis,* I and others (H. H. Hobbs, Jr., H. H. Hobbs, III, R. Bouchard, D. H. Stansbery, and J. F. Fitzpatrick, Jr., pers. comm.) concluded that *O. juvenilis* is a synonym of *O. rusticus*. What has been called *O. juvenilis* in Ohio seems different, however, from *O. rusticus*. *Orconectes rusticus* has an entire margin on the cutting edge of its mandible, a carina on the rostrum is absent, the first-form male has a smaller central projection/gonopod length ratio, and the female has two hemispheric bulges on the proximal portion of its annulus ventralis. The *O. juvenilis* has two notches on the cutting edge of its mandible, a carina is usually present, the first-form male has a greater central projection/gonopod length ratio, and the female has a flattened annulus ventralis. Therefore, I am suggesting that the Ohio *O. juvenilis* is either *O. spinosus* or a closely related undescribed species. Information is needed on the taxonomic status of this crayfish and its distribution and ecology in Ohio.

Literature: Turner 1926, Rhoades 1944a, and Hobbs 1974.

***ORCONECTES SANBORNII ERISMOPHOROUS* Hobbs and Fitzpatrick 1962.**

Range: Disjunct. Recorded from the Big Kanawha, Little Kanawha, and Greenbrier River drainages in West Virginia (Hobbs and Fitzpatrick 1962) and from the lower Scioto River in Ohio (D. H. Stansbery, pers. comm.).

Ohio Distribution: D. H. Stansbery (pers. comm.) collected this subspecies from one locality in Scioto Brush Creek, Scioto River drainage, Scioto County (Fig. 1).

Status: Special Interest (S). Nothing is known about the life history, ecology, or distribution of this subspecies within the state.

Literature: Hobbs and Fitzpatrick 1962.

CONCLUSIONS

The only Ohio crayfish that appears to be threatened is *O. sloanii*. *Orconectes obscurus* should be removed from the Ohio Department of Natural Resources threatened and endangered species list. Four crayfishes (*O. propinquus, O. virilis, O. s. erismophorous,* and *O. sp.*) belong in a special interest category because insufficient information exists to determine their status.

In retrospect, all of the Ohio crayfishes that are threatened or have special interest status are forms found mostly in moderate (>10 m width) to large-sized stream communities. If these species and subspecies are to survive, these communities must be protected from impoundment, siltation, channelization, and urban development. Also, the introduction of *O. rusticus* appears to be adversely affecting the native crayfish fauna. An effort should be made to control the introduction of this species in eastern Ohio and other areas that are outside of its natural range.

ACKNOWLEDGMENTS. I would like to thank Lee St. John and Marcy Loats of the Department of Zoology, The Ohio State University at Newark, Roger Thoma of the Ohio Environmental Protection Agency, and two anonymous reviewers for critically reviewing the manuscript. G. Whitney Stocker and the 1984-1985 summer field crews of the Ohio Environmental Protection Agency provided me with a large number of crayfish collections. Finally, Charlie King, director of the Ohio Biological Survey, has consistently encouraged me to continue my studies of Ohio crayfishes. Funds for the publication of this paper were provided by the Ohio Biological Survey, Columbus, Ohio.

LITERATURE CITED

Bundy, W. F. 1876 *In:* S. A. Forbes, List of Illinois crustacea with descriptions of new species. Bull. Illinois Mus. Nat. Hist., 1: 3-25.

——— 1877 On the Cambari of Northern Indiana. Proc. Acad. Nat. Sci. Phila., 29: 171-174.

Cooperrider, T. S. (ed.) 1982 Endangered and threatened plants of Ohio. Ohio Biol. Surv., Biol. Notes No. 16 iv + 92.

Cope, E. D. 1872 On the Wyandotte Cave and its fauna. Am. Nat., 6: 406-422.

Cottle, T. J. 1863 On the two species of *Astacus* found in upper Canada. Canada J. Indus. Sci., & Arts, 45(n.s.): 216-219.

Creaser, E. P. 1933a Seasonal changes in the male population of *Faxonius propinquus* (Girard). Occ. Pap. Mus. Zool: Univ. Michigan, 253: 1-9.

——— 1933b Age, growth, and sex ratios in the crayfish *Faxonius propinquus*. Pap. Michigan Acad. Sci., Arts, Lett. 19: 581-585.

Crocker, D. W. 1957 The crayfishes of New York State (Decapoda: Astacidae). New York State Mus. & Sci. Ser. Bull., 355: 1-97.

——— 1979 The crayfishes of New England. Proc. Biol. Soc. Wash. 92(2): 225-252.

——— and D. W. Barr 1968 Handbook of the crayfishes of Ontario. Toronto: Royal Ontario Mus. Univ. Toronto Press. Toronto. xiii + 158.

Erichson, W. F. 1846 Uebersicht der Arten der Gattung Astacus. Archiv. fur Naturgeschichte (Berlin), 12(1): 86-103.

Faxon, W. F. 1884 Descriptions of new species of Cambarus, to which is added a synonymical list of the known species of *Cambarus* and *Astacus*. Proc. Am. Acad. Arts and Sci., 20: 107-158.

Fielder, D. D. 1972 Some aspects of the life histories of three closely related crayfish species *Orconectes obscurus, O. sanborni,* and *O. propinquus*. Ohio J. Sci., 72(2): 129-172.

Fitzpatrick, J. F., Jr. 1967 The Propinquus group of the crawfish genus *Orconectes* (Decapoda: Astacidae). Ohio J. Sci., 67(3): 129-172.

Flynn, M. F. and H. H. Hobbs, III 1982 Parapatric crayfishes in southern Ohio: Evidence of competitive exclusion? J. Crustacean Biol., 4(3): 382-389.

Fowler, H. W. 1912 The crustacea of New Jersey. Ann. Rept. New Jersey Mus., 1911, Part II, p. 29-650.

Girard, C 1852 A revision of the North American Astaci, with observations on their habits and geographic distribution. Proc. Acad. Sci., Phil., 6: 87-91.

Hagen, H. A. 1870 Monograph of the North American Astacidae. Illus. Cat. Mus. Comp. Zool. at Harvard Coll., 3: viii-190.

Hay, W. P. 1902 Observations on the crustacean fauna of Nickajack Cave, Tennessee, and vicinity. Proc. U.S. Nat. Mus., 25: 417-439.

——— 1914 *Cambarus bartonii carinirostris* Hay. *In*: Walter Faxon, Notes on the crayfishes in the United States National Museum and Museum of Comparative Zoology. Memo. Mus. Comp. Zool. Harvard Coll., 40(8): 384-385.

Hobbs, H. H., Jr. 1969 On the distribution and phylogeny of the crayfish genus *Cambarus*. *In*: P. C. Holt, R. L. Hoffman, and C. W. Hart, Jr. (eds.), The distributional history of the biota of the southern Appalachians. Part I: Invertebrates. Research Monograph 1, Virginia Polyt. Inst., Blacksburg, Virginia. 1: 93-178.

——— 1972 The subgenera of the crayfish genus *Procambarus* (Decapoda: Astacidae). Smiths. Contrib. Zool., 117: 22 p.

——— 1973 New species and relationships of the members of the genus *Fallicambarus*. Proc. Biol. Soc. Wash., 86(40): 461-481.

——— 1974 A checklist of the North and Middle American crayfishes (Decapoda: Astacidae and Cambaridae). Smiths. Contr. Zool., 201: iii + 161.

——— and J. F. Fitzpatrick, Jr. 1962 A new crayfish of the Propinquus group of the Genus *Orconectes* from the Ohio drainage system in West Virginia (Decapoda: Astacidae). Proc., Biol. Soc. Wash., 75: 207-214.

Jezerinac, R. F. 1974 A record of *Orconectes virilis* (Decapoda: Astacidae) from Ohio. Ohio J. Sci., 74(4): 263.

——— 1982 Life-history notes and distributions of crayfishes (Decapoda: Cambaridae) from the Chagrin River basin, northeastern Ohio. Ohio J. Sci., 82(4): 181-192.

Lodge, D. M., A. L. Beckel, and J. J. Magnuson 1985 Lake-bottom tyrant. Nat. Hist., 94(8): 32-37.

Ohio Department of Natural Resources 1978 Endangered wild animals in Ohio. Ohio Dept. Nat. Res. Div. Wildlife Pub. 316 (R1276): 1-3.

Ortmann, A. E. 1905 The mutual affinities of the species of the genus *Cambarus*, and their dispersal over the United States. Proc. Amer. Phil. Soc., 44(180): 91-136.

——— 1906 The crayfishes of the state of Pennsylvania. Mem. Carnegie Mus., 2(10): iv + 343-524.

Rhoades, R. R. 1941 The distribution of *Cambarus sloani* Bundy in Ohio. Ohio J. Sci., 41(1): 93-98.

——— 1944a Further studies on distribution and taxonomy of Ohio crayfishes, and the description of a new subspecies. Am. Midl. Nat., 31(1): 111-149.

——— 1944b The crayfishes of Kentucky, with notes on variation, distribution and descriptions of new species and subspecies. Am. Midl. Nat., 31(1): 111-149.

——— 1962a Further studies on Ohio crayfishes. Case of sympatry of stream species in southern Ohio. Ohio J. Sci., 62(1): 27-33.

——— 1962b The evolution of the crayfishes of the genus *Orconectes* section limosus (Crustacea: Decapoda). Ohio J. Sci., 62(2): 65-96.

Schwartz, F. J. and W. G. Meredith 1960 Crayfishes of the Chear River watershed West Virginia and Pennsylvania. Part I. Species and localities. Ohio J. Sci., 60(1): 40-54.

Smith, H. G., R. K. Burnard, E. E. Good, and J. M. Keener 1973 Rare and endangered vertebrates of Ohio. Ohio J. Sci., 73(5): 257-271.

St. John, F. L. 1982 Crayfish and bivalve distribution in a valley in southwestern Ohio. Ohio J. Sci., 82(5): 242-246.

Turner, C. L. 1926 The crayfishes of Ohio. Bull. Ohio State Univ., 30(11): 145-195.

Van Deventer, W. C. 1937 Studies on the biology of the crayfish *Cambarus propinquus* Girard Illinois Biol. Mono. 15(3): 1-67.

Williamson, E. B. 1907 Notes on the crayfish of Wells County, Indiana, with description of a new species. 31st. Ann. Rept., dept. Geol. Nat. Res. Indiana, 1906, p. 749-763.